

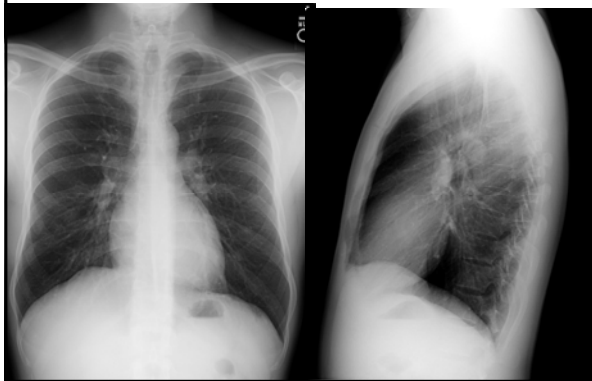
# FUNDAMENTALS of THORACIC IMAGING: I

Les Folio, DO, MPH  
COL, MC, USAF, SFS  
Assistant Professor of Radiology  
USUHS

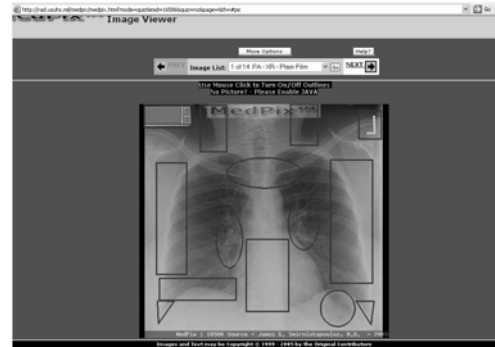
## Overview

- Terms Frequently Used and Misused
- “The Rules of Visibility”
- Normal Lung
  - Markings
- Demystifying the Lateral View
- The Airway

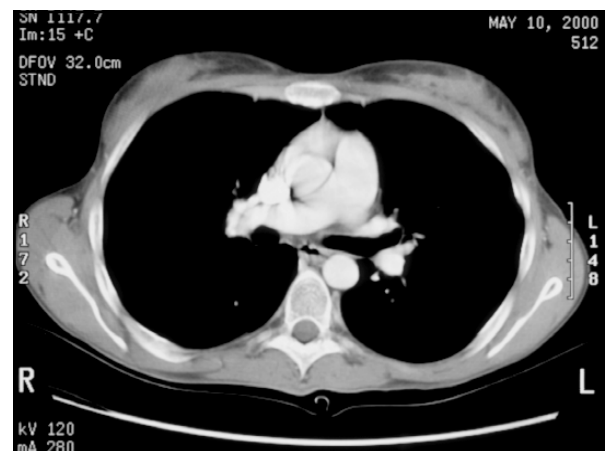
## PA and Lat

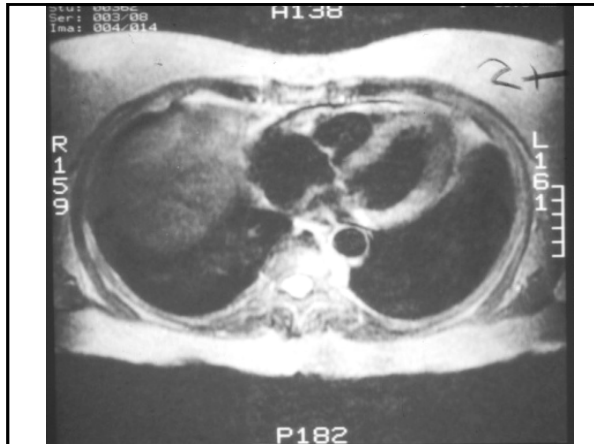


## MedPix: great source for CXR



• <http://rad.usuhs.mil/medpix/medpix.html?mode=quiz&imid=16586&quiz=no&page=&th=#pic>





## Terms Frequently Used (and often Misused)

**SHADOW** - Anything visible on an image; hence, any specific density or lucency

**DENSITY** - Whiteness, or any area of whiteness, on an image (opacity)

**LUCENCY** - Blackness, or any area of blackness, on an image

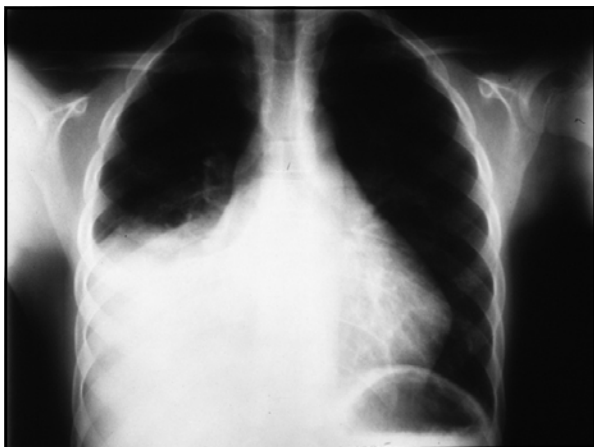
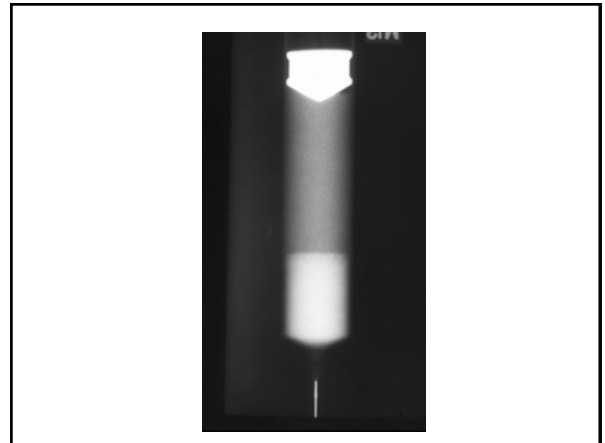
**EDGE** - Any visible demarcation between a density on one side and lucency on the other

**LINE** - A thin density with lucency on both sides or a thin lucency with density on both sides

**STRIPE** - Either edge or line

## Descriptor Terms

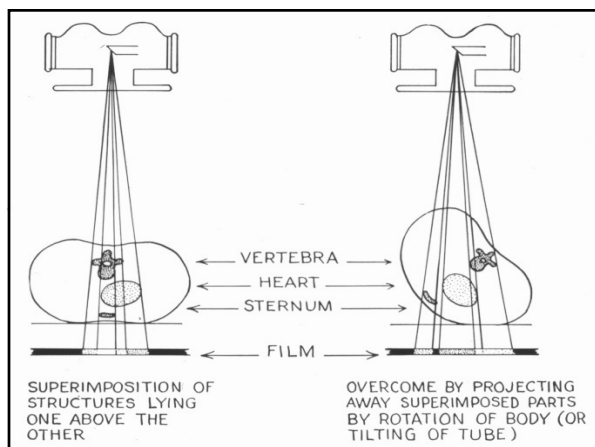
- **SILHOUETTE** - Synonym for edge;
  - loss of an edge constitutes the “silhouette sign”
- **Location** (i.e. anatomic)
- **Adjacent to...**
- **Surrounded by...** (think radiology)
- **Conspicuity** (con-spe-CUE-e-tee)
  - degree of “conspicuous-ness”
- **Pattern**
  - Mass, consolidate, infiltrate, vascular, airway



## **“The Rules of Visibility”**

### **“Rule number 1”**

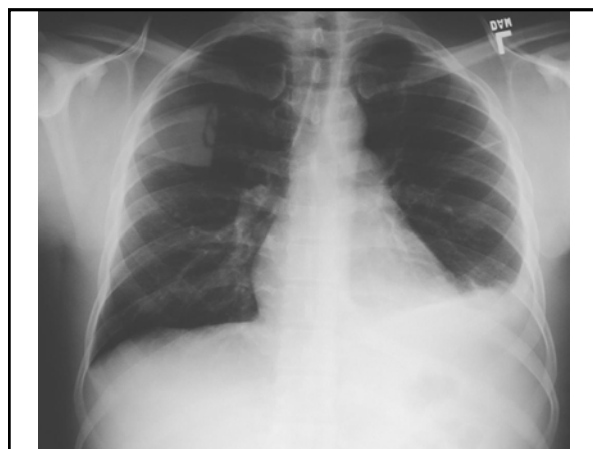
The edge of any structure is only visible if it is bordered by a structure of different fundamental density

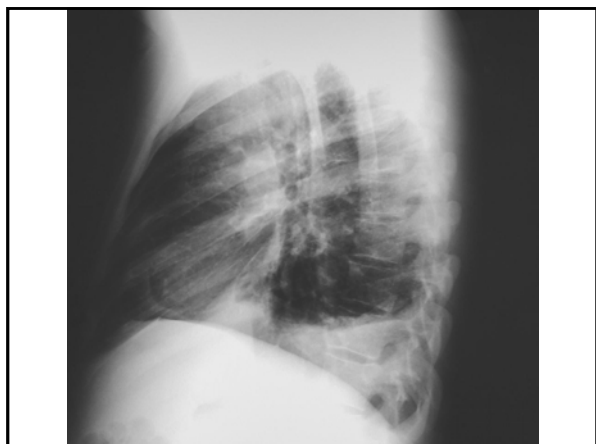


### **Rule #1**

On a chest radiograph, the only fundamental densities are soft tissues (including fat, blood/ fluid), calcium and even air (low density).

Rule number 1 is not altered by patient position, direction of x-ray beam, or by technique





## Rule #2

The lightness and darkness of any part of the image is the result of all structures through which the x-ray beam has passed

Lightness and darkness are easily changed by technique, but the whole film will be similarly affected



## Normal Lung

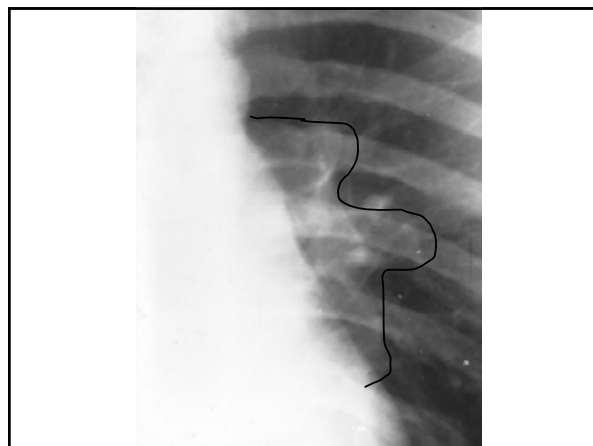
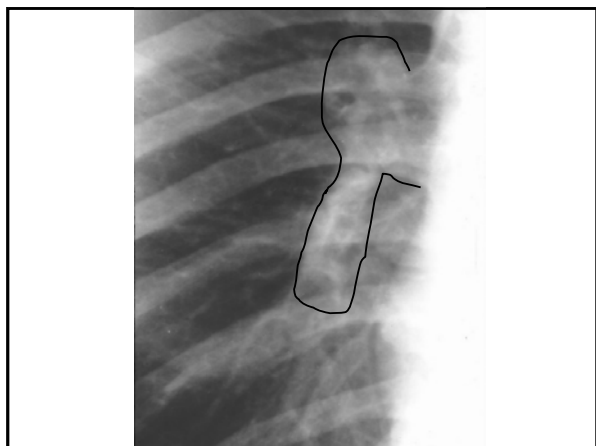
### The Hilum

The hilum is the anatomic connection of the lung to mediastinum and therefore consists of a variety of vessels, bronchi, and lymph nodes

The visible portion of each normal hilum is the right or left pulmonary artery

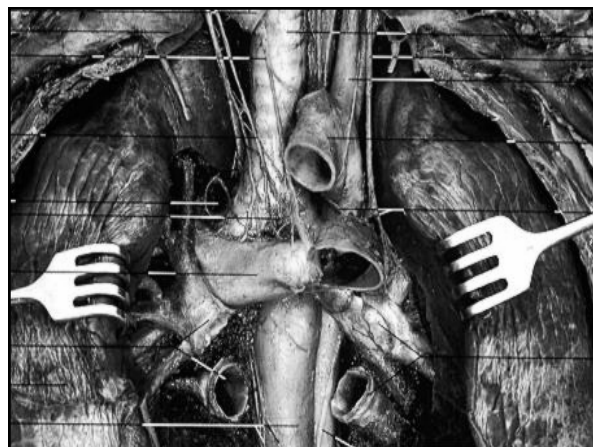
The pulmonary veins are inferior and posterior to the arteries

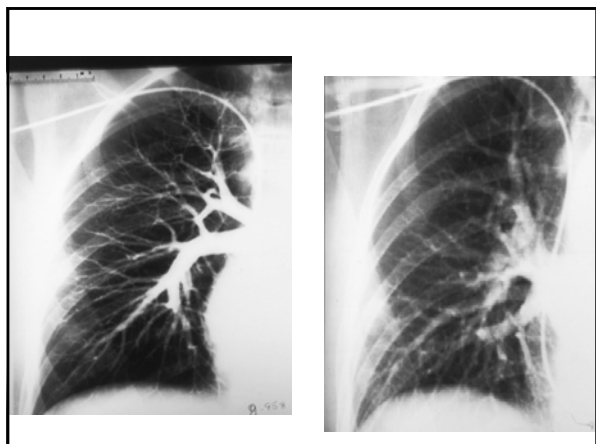




### Normal Lung - Hilum

- The pulmonary veins are inferior and posterior to the pulmonary arteries
  - Located behind the edges of the heart on the frontal view
  - Overlapping many other structures on the lateral view
  - The major bronchi are visible as lucencies
  - The lymph nodes are too small to be visible when normal

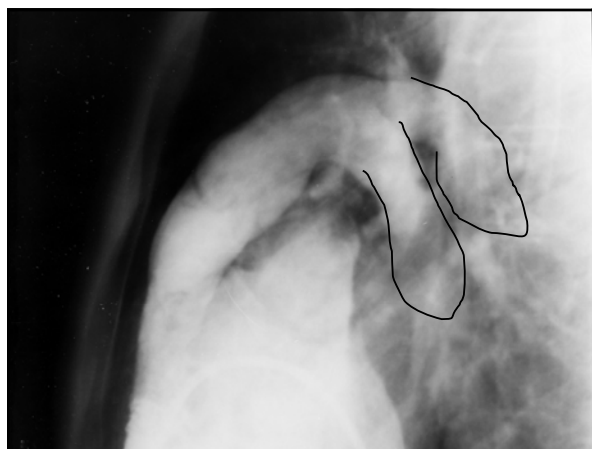
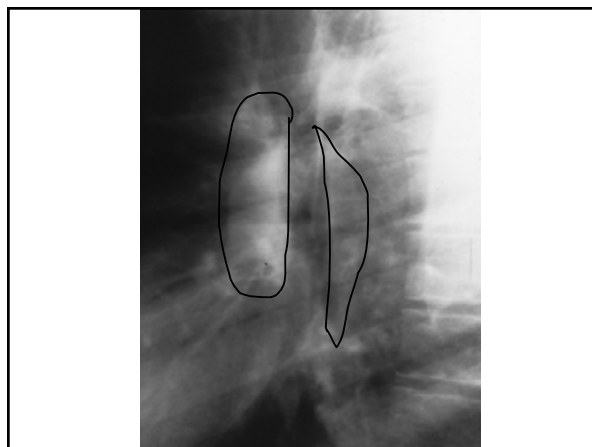


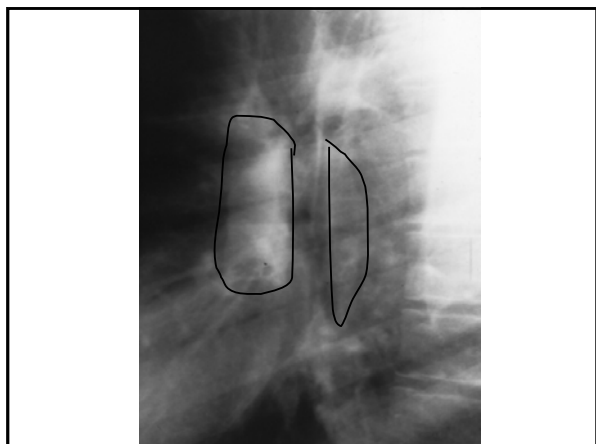


## Normal Lung - Hilum

The right and left pulmonary arteries are clearly visible on the lateral view, in the center of the image

The right pulmonary artery is just anterior to the air column (trachea continuous with main bronchi) and left pulmonary artery is just posterior



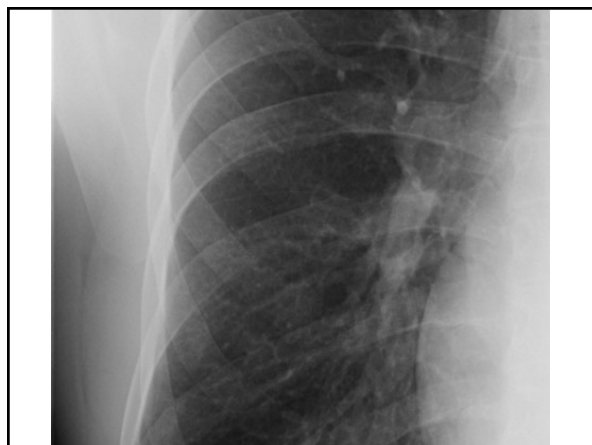


## Normal Lung Markings

The only normal densities within the lungs are the pulmonary vessels when filled with blood

The normal markings (vessels) can always be followed from the hilum toward the lung periphery in all directions

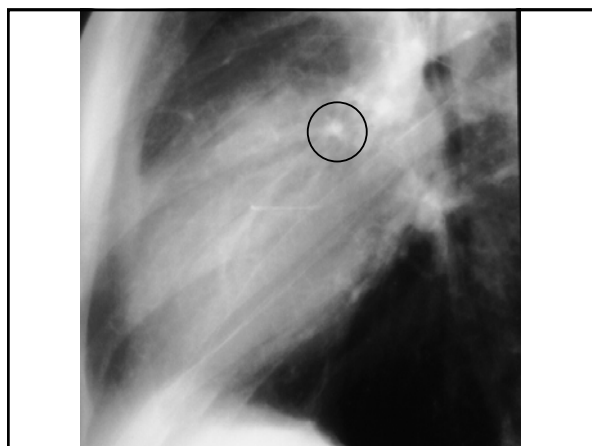
They branch at acute angles, taper and diverge toward the periphery

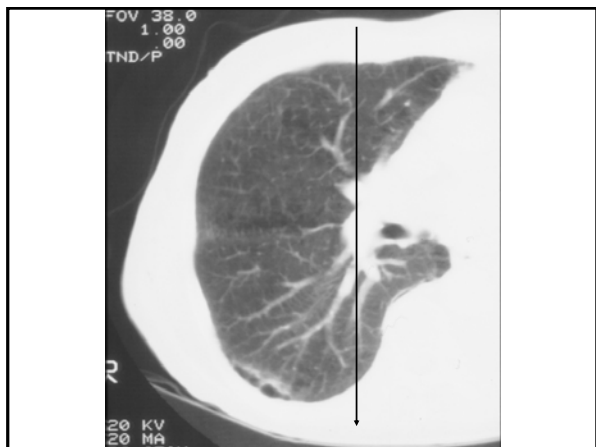
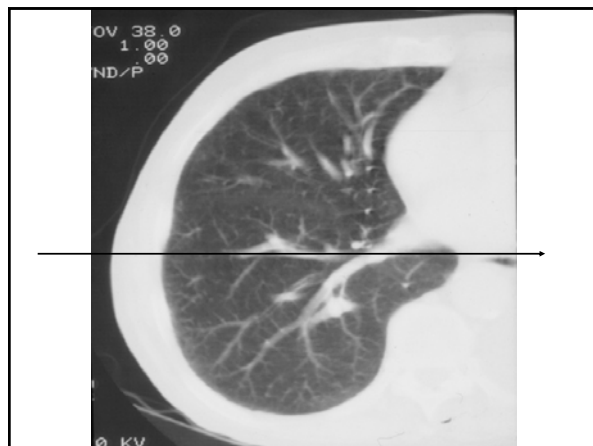
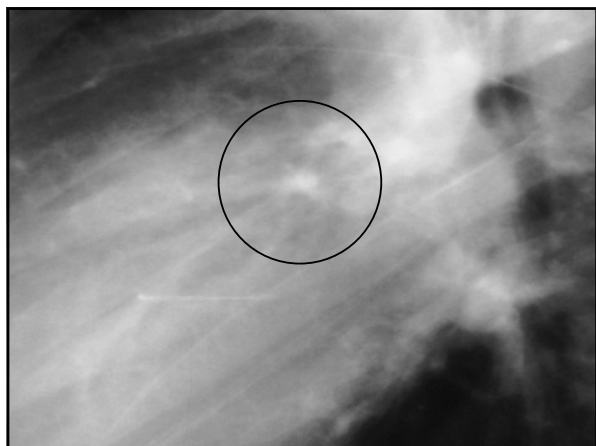


## Normal Lung Markings

Markings on end appear as small masses or nodules

They are recognized as normal vessels by the fact that they are superimposed upon vessels of the same diameter branching in other directions

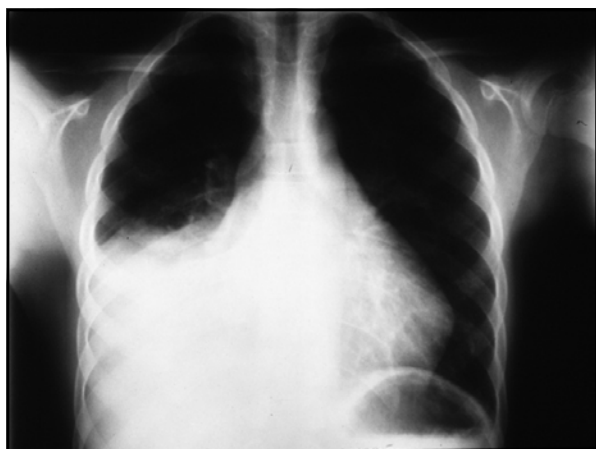




## Abnormal Lung Markings

Abnormal pulmonary markings are all shadows in addition to the normal markings

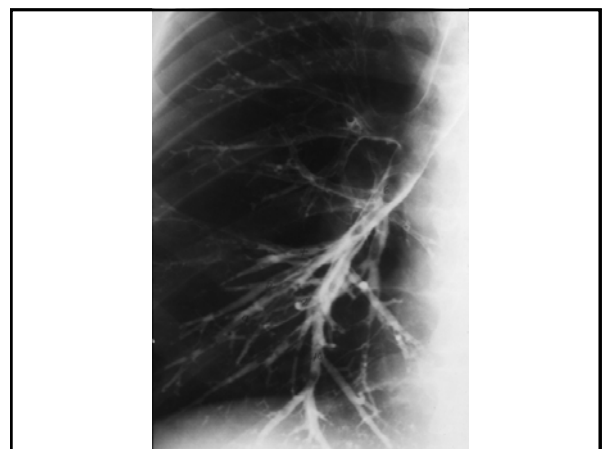
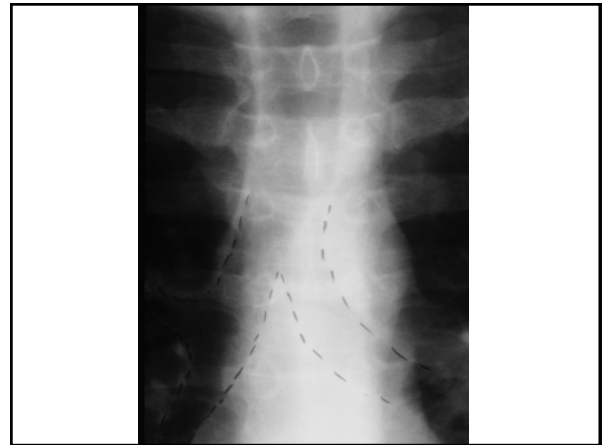
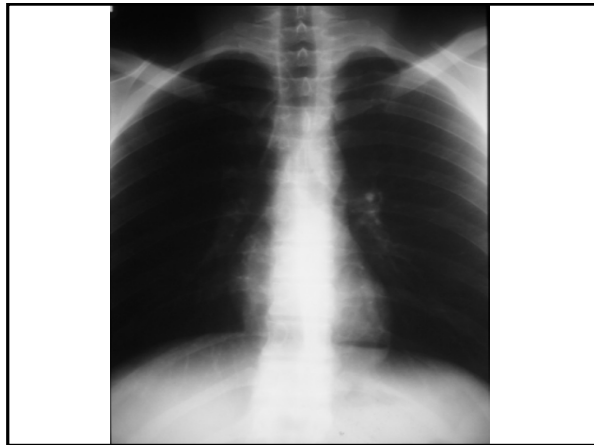
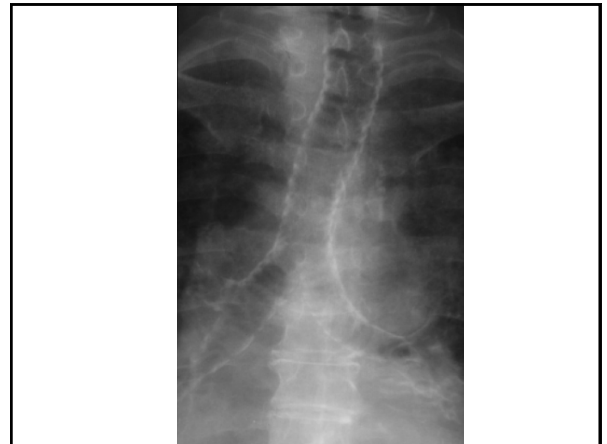
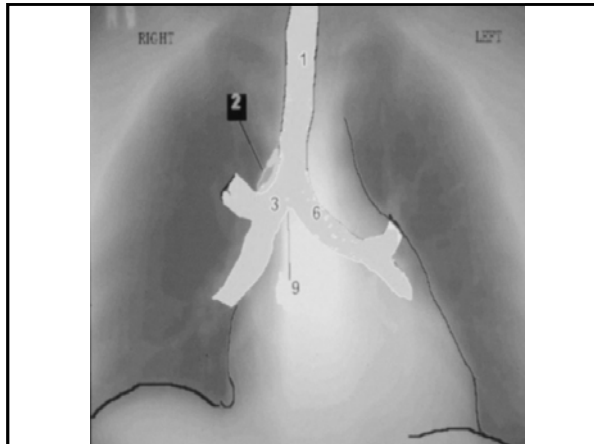
Many such shadows obscure the normal markings or displace them



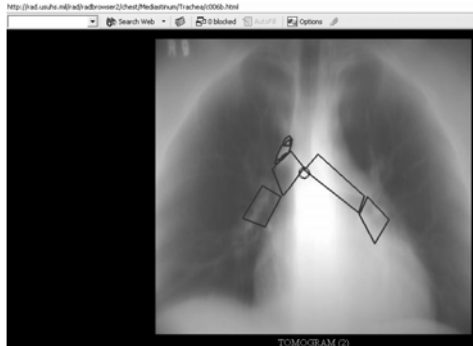
## The Airway

- The trachea is visible on both frontal and lateral views because it satisfies Rule #1
- The main bronchi are visible within the mediastinum and the medial portion of the hilum
- Once a bronchus is surrounded by air-filled alveoli, it becomes invisible because nearly all normal bronchial walls are too thin to be visible lines





<http://rad.usuhs.mil/rad/radbrowser2/chest/Medastinum/Trachea/c006b.html>

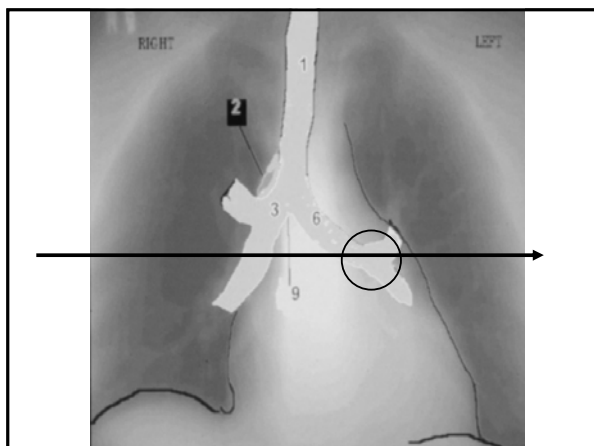
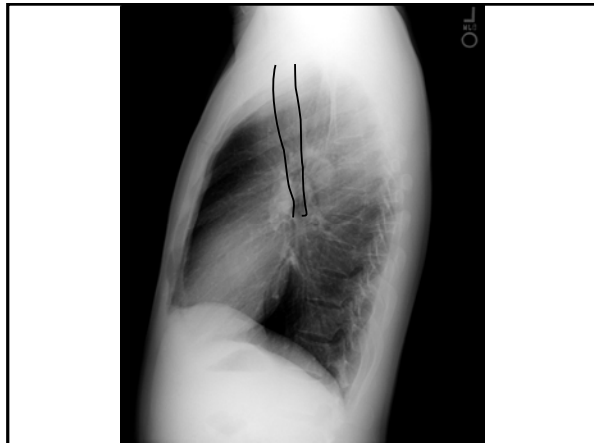


## Demystifying the Lateral View

The air column, which includes the trachea and largest bronchi, is visible because it satisfies Rule Number 1

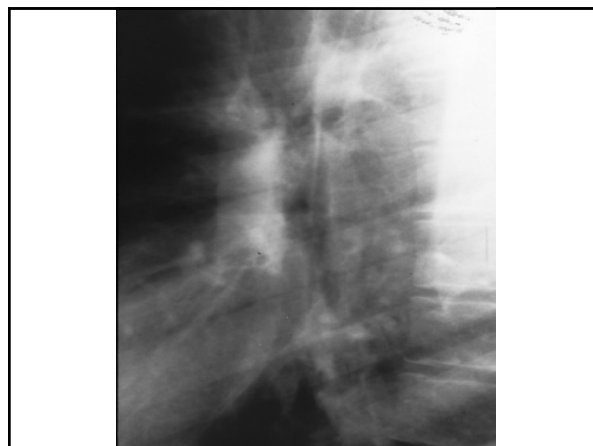
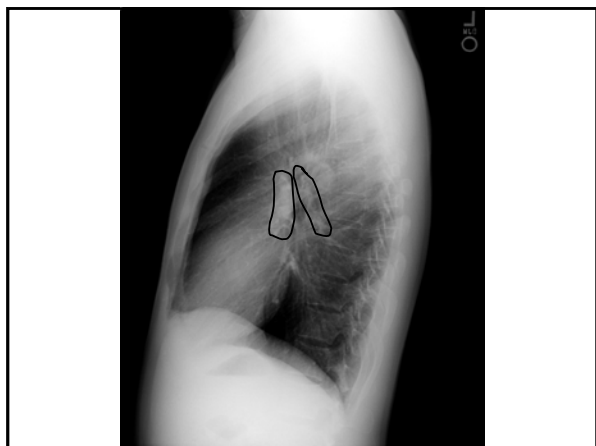
The carina is not visible on the lateral view because the main bronchi continue in the same direction as the trachea

The round lucency in the center of the lateral view is the distal portion of the left main bronchus as it becomes horizontal



## Demystifying Lateral View

The lateral view of the hila surrounds the left bronchial lucency

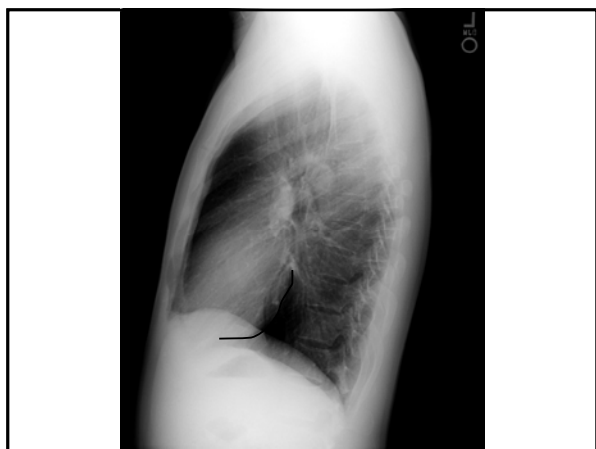


## Demystifying Lateral View

### The heart shadow

The only margin of the heart that is visible as a distinct edge is the back of the left ventricle, which satisfies Rule #1 by bordering the left lower lobe of the lung

The top of the heart shadow is never a distinct edge because the pulmonary artery and aorta, rather than lung, are directly above the heart

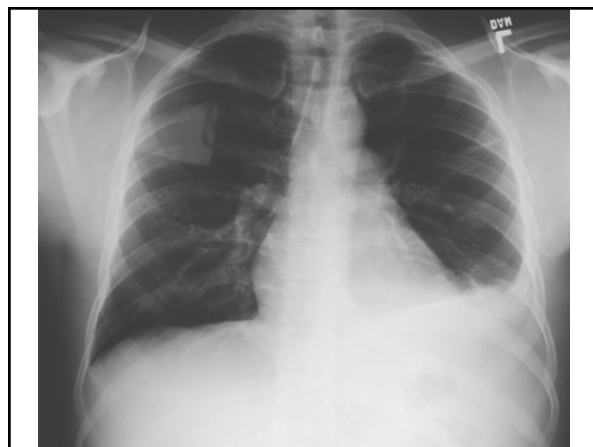
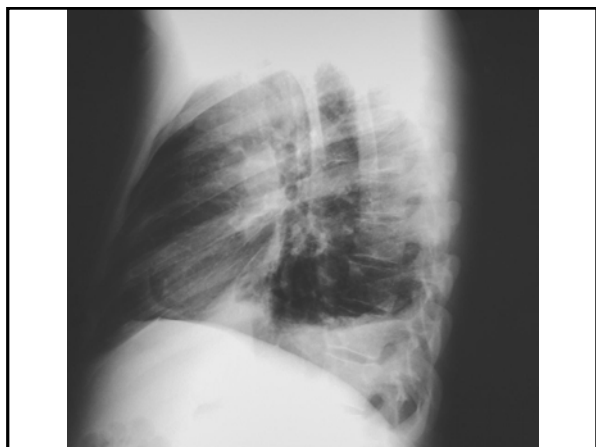


## Lateral View

The relative lucency above the heart shadow is caused by the relative thinness of the mediastinum in that region

It is thus an example of Rule number 2 and does not have distinct margins

The thoracic spine always appears increasingly lucent from top to bottom, until it crosses the diaphragms. This is another manifestation of Rule number 2



## Summary

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## Refs

- Chapter 37  
Introduction to Pulmonary Radiology  
**REGINALD M.E. GREENE MD and H.  
DIRK SOSTMAN MD**

**RADIOLOGY**  
2002 Edition on CD-ROM  
DIAGNOSIS ■ IMAGING ■ INTERVENTION  
JUAN M. TAVERAS & JOSEPH T. FERRUCCI